

M E R R T T

Waste Isolation Pilot Plant



INTRODUCTION

The Waste Isolation Pilot Plant (WIPP) has been designated as the world's first underground repository licensed to safely and permanently dispose of transuranic radioactive waste left from the research and production of nuclear weapons. The Department of Energy will be transporting transuranic waste (TRU waste) from various sites throughout the United States to WIPP. It is important that you are familiar with the process for transporting this material, should you have to respond to an accident involving material destined for WIPP.

In this module you will learn what WIPP is, and about the material being transported to WIPP. You will learn about the packages used to transport material to WIPP, and the safety measures in place to ensure that this material is moved safely throughout the United States.

PURPOSE

The purpose of this module is to increase your knowledge of the Waste Isolation Pilot Plant and its transportation system. Having an understanding of the material being transported to WIPP and how it is transported will increase your ability to quickly recognize, safely respond, and accurately relay information during an accident involving WIPP material.

OBJECTIVES

1. State the importance of the Waste Isolation Pilot Plant (WIPP).
2. Identify large quantity transuranic waste generator sites.
3. Identify waste verification techniques.
4. Identify the characteristics of the waste transported to WIPP.
5. Identify the packages used to transport waste to WIPP.
6. Identify the enhanced safety measures used to transport waste to WIPP.

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Overview of Waste Isolation Pilot Plant (WIPP)

As early as the 1950s, the National Academy of Sciences recommended disposal of radioactive waste in stable geologic formations, such as deep salt beds. Government scientists searched for an appropriate site during the 1960s, and tested the area of southeastern New Mexico in the 1970s. In 1979, Congress authorized WIPP. During the 1980s, the Department of Energy (DOE) constructed the facility 26 miles east of Carlsbad, New Mexico in the remote Chihuahuan Desert. After more than 20 years of scientific study, public input, and regulatory struggles, WIPP officially opened on March 26, 1999.

DOE's Carlsbad Field Office (CBFO) coordinates DOE's National Transuranic Program. The program is an effective way to manage transuranic waste from generation to disposal, and protect human health and the environment. WIPP is part of that system.

WIPP is the world's first underground repository licensed to safely and permanently dispose of transuranic radioactive waste left from the research and production of nuclear weapons. The waste consists of such things as laboratory clothing, tools, glove boxes, leaded rubber gloves, glassware and air filters, ash, salt metals, ceramic parts, plastics and solidified waste contaminated with man-made radioactive materials including plutonium and americium.



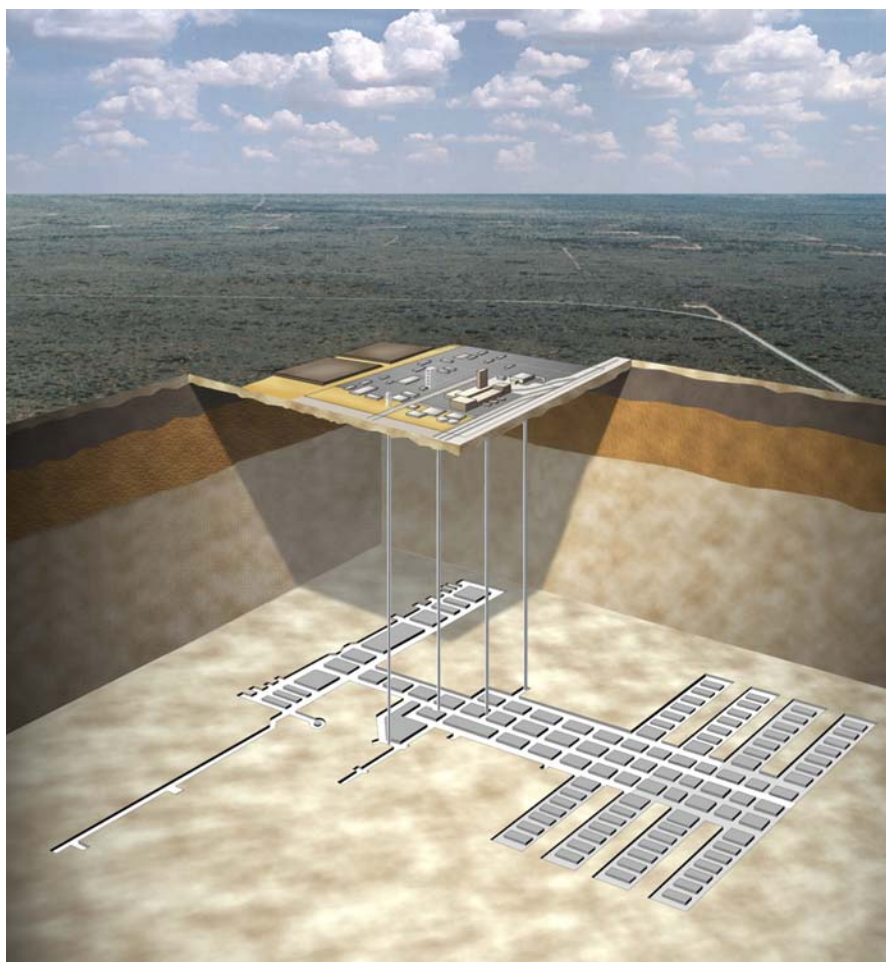
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Transuranic (TRU) waste began accumulating in the 1940s with the beginning of the nation's nuclear weapons program. A byproduct of the nuclear weapons program, this waste remains radioactive for thousands of years. Sound environmental practice requires this material to be permanently isolated, to protect future generations. Congress declared that DOE must not allow commercial or high-level waste at WIPP - only defense-related transuranic waste.

The project facilities include disposal rooms mined 2,150 feet underground in a 2,000-foot thick salt formation that has been stable for more than 200 million years. WIPP is expected to receive about 20,000 waste shipments over a 30-year period. Transuranic waste is currently stored at numerous locations nationwide.



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Numerous organizations are involved with the WIPP program and include the following:

- U.S. Environmental Protection Agency (EPA), certifies whether radioactive and hazardous material disposal requirements are met
- State of New Mexico, regulates handling of the hazardous components of mixed waste (waste that contains both radioactive and hazardous materials) under the authority of the Resource Conservation and Recovery Act (RCRA)
- New Mexico Environmental Evaluation Group, participates in and comments on various WIPP issues and activities
- Some two dozen other agencies, committees, and panels monitor the project's operations through regulation, review, and comment at the state and federal levels

WIPP's transuranic waste transportation system is setting the standard for safety. WIPP trucks, operated by highly trained drivers, carry transuranic waste in U.S. Nuclear Regulatory Commission certified packages. A satellite tracking system provides for monitoring of each shipment. The trucks meet the highest federal transportation standards and follow procedures for inclement weather, safe parking, and notification to state, tribal and, in some cases, local governments. WIPP-specific training of state, tribal, and local emergency response personnel is a key element of this safe transportation system.

In July 1989, the National Academy of Science stated: "The system proposed for the transportation of TRU waste to the WIPP is safer than that employed for any other hazardous material in the United States today and will reduce the risk to very low levels."

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WASTE GENERATOR SITES

There are numerous DOE sites that generate and have waste designated for transport to WIPP. Five DOE sites have the majority of the waste and are referred to as large quantity generator sites. These sites will ship for the life of the project. The five large quantity sites are:

- Idaho National Engineering and Environmental Laboratory
- Hanford Site
- Savannah River Site
- Los Alamos National Laboratory
- Rocky Flats Environmental Technology Site



The map above shows the major routes that will be used to transport transuranic waste to WIPP. Routing through each state has been determined with direction from the affected states and appropriate Governors' Associations. Selected routes satisfy the requirements of the U.S. Department of Transportation regulations in Title 49 of the Code of Federal Regulation (CFR) Part 397 (Transportation of Hazardous Materials; Driving and Parking Rules). Interstate highways and their alternate routes are used, when available, based on route safety and length.

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WASTE VERIFICATION TECHNIQUES

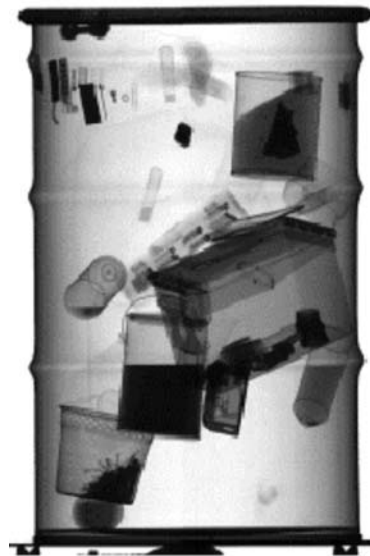
All waste destined for WIPP is required to be statistically sampled and analyzed to determine the contents within each package. The contents must meet WIPP's stringent Waste Acceptance Criteria. Audits are conducted at the generator site (site where the waste is generated) to ensure compliance. This criteria requires that the contents of each package be verified using the following methods:

Radioassay Device

This device is used to identify the radioactive contents of packages that are to be shipped to WIPP for disposal. This process also verifies the amount of radioactive material contained in the package.

Real-Time Radiography

Real-time radiography is also used to identify the waste package contents. This is conducted at the generator site and will assist in the characterization of package contents to ensure the WIPP Waste Acceptance Criteria is met. The process is very similar to the radiography (X-ray) used at the airport. The packages are placed on a machine that turns and tilts the package to determine the presence of liquids and any other prohibited items in the package. If prohibited items are found, the package must be disassembled and repackaged.



Head Space Gas Sampling and Analysis

Waste packages will have gas sampling performed to check for the presence of volatile organic compounds (VOCs). In order to meet the WIPP Waste Acceptance Criteria, the total concentration in the headspace of each payload container must be ≤ 500 ppm

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Radiological Surveys

Radiological surveys are conducted at both the generator site and upon arrival at WIPP. The surveys are conducted to ensure compliance with DOT packaging regulations. External radiation and contamination surveys are performed on each package and the transport vehicle.



Additional tests, in addition to those listed above, are performed to satisfy the WIPP Waste Acceptance Criteria. All of the tests listed above are designed to identify prohibited materials. Some examples of prohibited materials include:

- Explosives
- Corrosives
- Compressed gases
- Free liquids in excess of 1% total volume

In addition to the prohibited materials above, hazardous waste exhibiting the characteristics of ignitability, corrosivity, or reactivity is not acceptable at WIPP.

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CHARACTERISTICS OF THE WASTE TRANSPORTED TO WIPP

TRU Waste

Transuranic waste (TRU waste) is radioactive waste contaminated with transuranic elements such as plutonium (Pu), curium (Ce), americium (Am), and californium (Cf). It is not economically feasible to recover the transuranic material from the waste.

The majority of DOE's TRU waste—transported to and disposed of at WIPP—consists of everyday items such as rags, rubber gloves, shoe covers, cloth lab coats, laboratory glass, and plastic bags. Heavier items destined for disposal include valves, pumps, motors, tools, dirt, and building materials.

Contact Handled (CH) TRU Waste

97% of the waste destined for WIPP is Contact Handled TRU Waste (CH-TRU waste). In order to be characterized as CH-TRU waste, the maximum surface dose rate on the CH-TRU package must be less than 200 mrem/hr. The typical dose rate at the surface of a CH-TRU waste package (55-gallon metal drum or standard waste box) will be 3 to 10 mrem/hr. Because of the low dose rates, personnel can safely handle CH-TRU waste packages without the use of special equipment.

Remote Handled (RH) TRU Waste

Remote Handled TRU-Waste (RH-TRU waste) will be transported in heavy shielded casks similar to the type used for spent nuclear fuel transport. RH-TRU waste will have a surface dose rate on the inner package (drum or RH canister) of less than or equal to 1,000 rem/hr. At least 95% of the RH-TRU waste packages will have an external dose rate less than or equal to 100 rem/hr. RH-TRU waste will contain the same material as CH-TRU waste. The only difference between CH and RH waste is the external dose rate. Remote handled material requires the use of special equipment and controls to move the inner packages. Personnel will not come in contact with this material during packaging or transport.

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Once RH-TRU waste is prepared for shipment, the radiation level will not exceed 200 mrem/hr at any point on the external surface of the shipping cask.

Mixed Waste

The majority of the waste destined for disposal at the Waste Isolation Pilot Plant will be Contact Handled TRU Mixed Waste. Mixed waste is waste that contains a hazardous waste component and a radioactive material component. Mixed waste disposal must meet the requirements of the Resource Conservation and Recovery Act as well as requirements in the Atomic Energy Act before disposal at WIPP.

PACKAGING USED TO TRANSPORT TRU WASTE TO WIPP

WIPP Type A Packaging

WIPP uses Type A packaging to store transuranic waste. These packagings are either 55-gallon metal drums, pipe overpack drums, or standard waste boxes.



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WIPP packages are placed inside either the TRUPACT-II or the HalfPACT at the generator site for shipment. Once received at WIPP, the TRUPACT-II or HalfPACT will be unloaded and the packages removed. The packages are then placed in the WIPP underground for permanent disposal.

Pipe Overpack

The pipe overpack is a special package used in the transport of transuranic waste. It is used within the TRUPACT-II to contain certain wastes contaminated with higher concentrations of plutonium and americium. The pipe overpack is placed inside a 55-gallon drum, which is then placed inside the TRUPACT-II.

The pipe overpack has three functions:

1. To maintain separation of fissile material
2. To provide shielding from radiation
3. To immobilize fine particulate waste material (e.g., ash)

DOE estimates the pipe overpack will be used in less than five percent of the CH-TRU waste shipments destined for WIPP.

The Nuclear Regulatory Commission approved the use of the pipe overpack as part of the TRUPACT-II. The pipe overpack cannot be used to transport transuranic waste unless it is inside a TRUPACT-II. Pipe overpack testing at Sandia National Laboratories included a top-impact drop test, a side-impact drop test, and a leak test. There was no loss of contents during these tests.

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WIPP Type B Packaging

TRUPACT-II

The Transuranic Packaging Transporter Model 2, (TRUPACT-II) is a stainless steel package approximately eight feet in diameter, 10 feet high, and constructed with leaktight (non-vented) inner and outer containment vessels. The TRUPACT-II can hold up to 14 fifty-five gallon waste drums or two standard waste boxes (63 cubic feet capacity each). The 14 drums are configured into 2 packs containing 7 drums each. A fully loaded TRUPACT-II can weigh up to 19,250 pounds.

The TRUPACT-II underwent extensive testing at Sandia National Laboratories in Albuquerque, New Mexico. It is certified by the Nuclear Regulatory Commission (NRC), and meets the U.S. Department of Transportation (DOT) safety requirements for a Type B Package.

HalfPACT

Some shipments to WIPP will consist of 55-gallon drums of CH-TRU waste weighing as much as 1,000 pounds each. Although the TRUPACT-II transportation packages are designed to hold as many as 14 drums, the total shipment (including the truck and trailer) can weigh no more than 80,000 pounds under DOT weight restrictions. To comply with these restrictions, shippers of heavier-than-average drums of transuranic waste would have to reduce the number of drums per package below the TRUPACT-II's 14 drum capacity.



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To improve shipment efficiency for heavier drums of transuranic waste, DOE designed the HalfPACT. It is constructed similar to that of the TRUPACT-II. However, 30 inches have been taken off of the height of the package. As a result, the HalfPACT is shorter, and therefore lighter, than the TRUPACT-II. Each HalfPACT is approximately 7 ½ feet high and 8 feet in diameter. The HalfPACT is designed to hold seven 55-gallon drums or one standard waste box. Each WIPP transport truck can haul up to three HalfPACTs.

Use of the HalfPACT will allow a greater volume of the heavier waste to be transported in each shipment. This will limit the number of shipments necessary and, therefore, the potential for accidents.

The HalfPACT underwent extensive testing at Sandia National Laboratories in Albuquerque, New Mexico. It is certified by the NRC, and meets the DOT safety requirements for a Type B Package.

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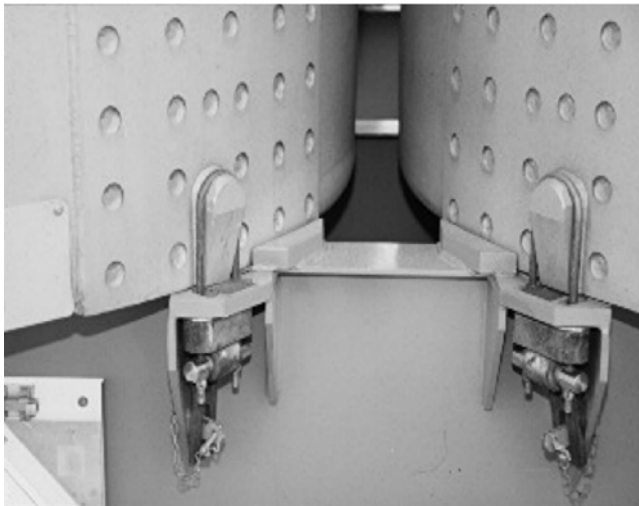


Tie-down Assembly

The TRUPACT-II and the HalfPACT have four “U”-shaped tie-down assemblies (U-bolts) that hold them in place on the trailer (see photo below). The U-bolts are not designed to shear off, instead they will deform or break, thereby preventing damage to package skin. Each of the four U-bolts used on each package was load tested to 20,000 lbs. This gives the tie-down assembly a total capacity of 80,000 lbs.

By Nuclear Regulatory Commission requirements, tie-down lugs, which are part of the package, must be able to withstand ten times the force of the package in the forward and aft direction, five times the force in the lateral direction, and two times the force in the vertical direction.

At an incident scene, a visual check of the tie-downs should be made to ensure they are still intact before allowing personnel into the area near the package(s). If the tie-down is obviously broken, deformed, or missing, keep all personnel clear. This is to prevent injury in case the TRUPACT-II or the HalfPACT should fall from the trailer.



Remote Handled Transuranic Waste Package

Some transuranic waste emits high levels of penetrating gamma radiation. This RH-TRU waste must be shipped in packages that provide additional shielding. The RH-72B was designed to safely transport these wastes. Like the TRUPACT-II and the HalfPACT, the RH-72B is leaktight and constructed with inner and outer containment vessels. It is a large cylinder approximately 12 feet long and approximately 3½ feet in diameter. RH-TRU shipments are expected to begin in 2002.

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RH-TRU Waste Shipping Cask

The RH-72-B (pictured below) is a stainless steel, lead-shielded cask designed to provide double containment for shipments of transuranic waste material. The package consists of a cylindrical stainless steel and lead cask body and a separate inner stainless steel vessel. Additionally, foam-filled impact limiters at each end of the cask body protect the package and its contents in the event of an accident.



The cask body is constructed of an outer shell of stainless steel approximately 1 ½ inches thick, 41 ⅞ inches in diameter, with approximately 2 inches of lead shielding between the outer and inner shell, and a 1 inch inner shell of stainless steel. This produces a package that is considered to be a double containment vessel (two vessels in one). The lid on the cask body is made of 6 inches of stainless steel held in place by 18 stainless steel bolts. The inner containment vessel has a 6 ½ inch thick lid held in place by 8 bolts. One RH canister, which holds three 30 or 55-gallon metal drums, will be placed inside the RH-72-B cask. Additionally, there may be one-gallon pails containing waste placed inside the drums. The canister can be loaded directly with items too large to fit inside drums. The canister is made of carbon steel approximately ¾ inches thick. Once filled with waste and the lid welded on, the canister will be disposed of in the WIPP underground along with the waste. Each shipment of RH-TRU waste will contain only one cask and canister weighing up to 45,000 pounds.

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CNS 10-160B Shipping Cask

A second type of cask is being readied for use at WIPP to transport RH waste material. This cask is the Chem-Nuclear CNS 10-160B. The CNS 10-160B cask body has an outer shell constructed of 2 inches of carbon steel, with a center gamma shield constructed of $1 \frac{7}{8}$ inches of lead, and a $1 \frac{1}{8}$ inch inner shell of carbon steel. Both the bottom and the lid of the cask are constructed of $5 \frac{1}{2}$ inches of carbon steel. The lid is held in place by 24 $1 \frac{3}{4}$ inch steel bolts.

Only one CNS 10-160B cask is placed on a trailer for transport. The cask will carry ten drums in two five drum packs.

Impact limiters are placed on each end of the package for added protection in the event of an accident. The impact limiters are constructed of a fully welded steel shell filled with polyurethane foam. The foam deforms and provides energy absorption during impact. One of the impact limiters is positioned on the bed of the trailer, the cask is then placed on the impact limiter, and the top impact limiter is placed on the cask. Eight ratchet binders hold the two impact limiters in place.

ENHANCED SAFETY MEASURES

Transportation Carrier Requirements and Driver Training

The transportation contractors used to transport TRU waste to WIPP must have an approved equipment maintenance plan in place for their tractors and trailers and carry the required insurance for hazardous material transport. The equipment maintenance plan requires the transportation contractor to replace a used or defective tractor if it breaks down more than 2% of the time.

The tractor and trailer are equipped with anti-lock braking systems and are governed to a speed of 65 miles per hour. Comprehensive emergency response plans and a contingency plan are carried in the vehicle. The transportation contractor must have a remediation (hazardous material clean-up) contractor on standby at all times when material is in transport.

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Each truck transporting material to WIPP will have two drivers who carry a cellular phone and a satellite phone. Each shipment will also utilize a satellite communications and tracking system called TRANSCOM. TRANSCOM is administrated and managed by the DOE-AL National Transportation Program in Albuquerque, New Mexico. The WIPP Central Monitoring Room is one of the DOE customers that utilize TRANSCOM to monitor the progress of each shipment.

Once en route with a shipment, the drivers must stop within the first 25 miles to perform a load inspection. Load inspections must continue to be performed every two hours or every 100 miles (whichever occurs first) throughout the trip.

Driver Qualifications

Like the vehicles used for transporting material to WIPP, the drivers are also subject to very strict standards and a stringent set of rules. Prior to employment, all drivers must pass a criminal background check. Some of the requirements for drivers transporting material to WIPP include:

- Having no convictions for DWI or DUI
- Must meet all U.S. Department of Transportation requirements for shipping a hazardous material
- Must be at least 21 years of age
- Must have 325,000 miles of documented semi-tractor trailer experience in the past five years
- Must have no chargeable incidents or moving violations in a commercial motor vehicle in the last five years
- Must have two years uninterrupted semi-tractor commercial driving experience in the last five years
- Must have a commercial drivers license with the proper endorsements
- Must pass an annual physical and random drug screens
- Must go through peer review and have favorable results on interview for dual driver compatibility
- Must obtain Commercial Vehicle Safety Alliance (CVSA) vehicle inspector training
- Must successfully complete the MERRTT/WIPP First Responder Radiological Emergency course

Check Your Understanding



1. WIPP is the world's first underground repository licensed to safely and permanently dispose of _____ radioactive waste.
2. In accordance with the WIPP Waste Acceptance Criteria, which of the following is an example of a prohibited material?
 - a. Any material containing gamma-emitting isotopes
 - b. Transuranic isotopes
 - c. Compressed gases
 - d. Contaminated protective clothing
3. Contact Handled (CH) TRU Waste has a maximum surface radiation dose rate of:
 - a. 5 mrem/hr
 - b. 200 mrem/hr
 - c. 1,000 mrem/hr
 - d. There is no dose rate limit on CH TRU Waste
4. 97% of the waste destined for WIPP is CH-TRU Waste. True/False.
5. TRUPACT-II is a stainless steel package approximately 8 feet in diameter, 10 feet high, and constructed with leaktight inner and outer containment vessels. True/False.
6. Which of the following is **not** true regarding the drivers used for transporting material to the WIPP site?
 - a. Must pass a criminal background check
 - b. Must have 325,000 miles of documented semi-tractor trailer experience in past 5 years
 - c. Must have no more than two moving violations in the past year
 - d. Must pass an annual physical to include random drug screens

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ANSWERS

1. transuranic
2. c
3. b
4. True
5. True
6. c